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Environmental Education During the COVID-19 Pandemic

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by

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DEDICATION

Dedicated to Anthony, who has supported me through everything in every way and who has been the very best person to be stuck with in lockdown.

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CHAPTER ONE

Introduction

Overview

The COVID-19 pandemic that hit the United States in March 2020 quickly caused the entire nation to rethink how we work and how we approach education. Informal environmental education in particular faced unique challenges during this time yet found ways to adapt their educational programming. This thesis will explore the questions: *How did organizations alter and adapt their programming to meet public health guidelines during the pandemic?* and *What successes and challenges did organizations face in offering these programs?* This information will help environmental educators consider a broader range of formats for programming as the pandemic continues and as organizations recover from the setbacks created by the crisis. This chapter outlines the background of the situation and my personal interest in researching this question.

Online learning is not new but many teachers found themselves ill prepared and poorly supported by their schools. Informal educational organizations faced additional problems of small, independent budgets, minimal staff, and now even fewer volunteers that help their organizations provide educational programming. For those organizations providing informal environmental education, the ability to teach students on field trips, in after school programs, and weekend nature walks was seemingly null.

Yet environmental educators are creative and resilient. Working outdoors and with ever changing groups of people of all ages has prepared these professionals to adapt to these changes. It wasn't long into the pandemic that I noticed many environmental

education organizations offering resources for visitors to use during their independent visits to parks and centers, virtual webinars and workshops about locally relevant environmental and conservation topics, opportunities to participate in community science activities, and take home nature kits. There was a great deal of variety in what I was anecdotally seeing offered. I wondered how many organizations across the country were offering new types of programming, how varied those offerings were, and what was proving to be successful. This curiosity is the basis for the central research topic in this thesis.

A Pandemic Begins

In 2019, I began teaching environmental education (EE) for the first time. I taught throughout the fall season with the promise that I would return to do more in the Spring. Doubt about this began to creep in in early 2020 as the news reported about the COVID-19 virus spreading rapidly around the world. On March 11, 2020, the World Health Organization described the spread as a pandemic (Chappell, 2020). Two days later, Governor Wolf of Pennsylvania closed schools (*Pennsylvania, Delaware Close All Schools Due to Outbreak*, 2020) and three days after that he expanded a shutdown order for the entire state (*Coronavirus Update*, 2020). The next day, March 17, I received the anticipated email that the field studies program I'd been teaching for would be canceled indefinitely (N. Pasquier, personal communication, March 17, 2020).

As someone just getting started in the field of EE, I was disheartened to see the trend of canceled EE programs across the state and around the country in the weeks that followed. Summer is a big season for EE, and one also marked by many fundraising events and revenue-generating summer camps. Many organizations that offer EE rely on

these funding sources and several feel that long-term closures and cancellations of such events and programs will put their organizations in jeopardy (Collins et al., 2020).

Soon, though, EE organizations and environmental educators were announcing webinars, Facebook Live events, collections of online resources, and guides for trails and community science activities that people could do on their own or with their families. These types of programs and resources became more and more common as the pandemic wore on. Eventually, the research about how the COVID-19 virus spreads showed that wearing masks and social distancing were quite effective at limiting spread, and also that being outdoors drastically decreased the chances of transmission (“‘Please, Go Outside,’” 2020; Qian et al., 2020), and some outdoor EE programs resumed, with a mask requirement and limited attendance.

Conclusion

This thesis will begin with a review of the literature relevant to this research. Few studies have yet been conducted on how the pandemic has impacted EE. Much more work has been done studying how online learning has impacted formal educational settings. These studies have shown the educational and social impacts of online learning and provide case studies for different methods for creating a successful online learning experience.

The literature review will also explore online learning more broadly and how technology has been used in EE and other science contexts. Based on anecdotal evidence suggesting that EE organizations are employing certain types of programming, the review

explores the use of mobile devices, social media, citizen, or community, science, online field trips, and analog signs and displays in informal education, including informal EE.

After the literature review, this thesis will describe the methods used to gather data. A survey was distributed to EE professional organizations and participants were able to opt in to follow-up interviews. From this mixed methods approach I was able to analyze the responses to get a picture of what kinds of EE programs were offered during the pandemic and which of these educators found to be successful. The results are discussed in chapter 4. The conclusion in chapter 5 will discuss implications for these results, including applications and future research.

CHAPTER TWO

Literature Review

Introduction

This literature review will explore some of the formats for remote and asynchronous teaching commonly used in education as well as the growing body of literature on how the pandemic impacts learning and teaching.

Education has never faced a situation quite like the current pandemic. As such, there is limited research on how the public health crisis and its related social distancing and stay at home orders have impacted teaching and learning. From the emerging literature and anecdotal observations of programming being offered by environmental education (EE) organizations, it can be presumed that much of the programming is taking place online. Online and distance learning is well researched and what primary and secondary schools, higher education, museums, zoos, and EE organizations learned before the COVID-19 outbreak can be applied to our present situation. These studies will help inform the answer to the questions: *How did organizations alter and adapt their programming to meet public health guidelines during the pandemic?* and *What successes and challenges did organizations face in offering these programs?*

Environmental Education

The 1977 Tbilisi Declaration, a foundational document in the field of EE, defines EE as "a learning process that increases people's knowledge and awareness about the environment and its associated challenges, develops the necessary skills and expertise to address the challenges, and fosters attitudes, motivations, and commitments to make

informed decisions and take responsible action." (UNESCO & UNEP, 1978). The document further outlines goals, outcomes, and guiding principles for the field. The Declaration has given the field an anchor to ground EE as a research discipline and as a field of practice. Outcomes for EE programming are often defined and measured in terms of those from the Tbilisi Declaration (Ardoin et al., 2018; Stern et al., 2014; Thomas et al., 2019). Those outcomes are:

> **Awareness—**to help social groups and individuals acquire an awareness and sensitivity to the total environment and its allied problems.
>
> **Knowledge**—to help social groups and individuals gain a variety of experience in, and acquire a basic understanding of, the environment and its associated problems.
>
> **Attitudes**—to help social groups and individuals acquire a set of values and feelings of concern for the environment and the motivation for actively participating in environmental improvement and protection.
>
> **Skills**—to help social groups and individuals acquire the skills for identifying and solving environmental problems.
>
> **Participation**—to provide social groups and individuals with an opportunity to be actively involved at all levels in working toward resolution of environmental problems.
>
> (UNESCO & UNEP, 1978).

For the purposes of this research, EE organizations are any organization that offers educational programming and opportunities that meet these definition or outcomes of EE.

While EE can take place in formal education settings, this research focuses on EE that takes place either informally with the guidance of an environmental educator or non-formally as the learner experiences the environment without guidance (see Eshach, 2007, for more about informal and non-formal learning).

Most of this EE takes the form of field trips, camps, public programs, workshops, guided hikes, and many others (Dalen, 2013) and is carried out by organizations in natural environments. It is particularly valuable that these experiences are offered onsite and in person, as the benefits of time spent in natural areas are well documented. Evidence shows that outdoor activities have benefits for children and adolescents related to their physical activity, reading performance, creativity and imagination, motivation in school, prosocial behaviors including teamwork, and their socio-emotional and mental health (Dankiw et al., 2020; Gill, 2014; Holland et al., 2018; Mann et al., 2021; Mygind et al., 2019; Tillmann et al., 2018).

Organizations that provide EE also offer facility and equipment rentals and public access to green space (Dalen, 2013) that can provide opportunities for these benefits and for non-formal learning. As social distancing guidelines were put in place during the COVID-19 virus outbreak, people began to take advantage of these spaces in record numbers (Barthel & Pascale, 2020; Membreno, 2021; Ritchie et al., 2021), reporting some of these same benefits.

Enter the Pandemic, Pursued by a Bear

When the COVID-19 pandemic caused lockdown and stay-at-home orders around the country, many organizations that offer EE had to cancel events and shutter the doors to their facilities. Some parks even closed to the public (i.e. Gilbert, 2020). At this early stage of the pandemic, it was assumed that the closures would be temporary. As it became clear, however, that the pandemic would carry on for months, nonprofits, including EE organizations, began to be concerned (Collins et al., 2020; Erdody, 2020; Rendon, 2021). Most EE organizations are nonprofits (Collins et al., 2020; Dalen, 2013) and things were looking rather dire as many rely on fundraising events, programming, and donations to fund their work. In the survey conducted by Collins et al. in April 2020, seventy one percent of respondents from environmental and outdoor science education programs felt they could very likely or definitely reopen if the pandemic's social distancing guidelines were relaxed by May 2020, while only 37% felt the same if the guidelines were to be in effect through December 2020 (Collins et al., 2020). As of this writing, no information about the closure of EE organizations has been published.

Inequitable Nature

The pandemic wasn't the only event of early 2020 to make environmental educators take stock of how they offer programming. On May 25, the murder of George Floyd by a police officer in Minneapolis, MN sparked outrage across the country and highlighted injustices faced by Black and other people of color (Taylor, 2021). That same day, a white woman in New York City's Central Park was filmed calling the police to falsely accuse a Black man who was birding there of harming her (*Being Black While in Nature*, 2020; *#BlackInNature*, n.d.). This incident brought the conversations about

justice, equity, and inclusion happening around the country to the EE field as the resulting social media events #BlackBirdersWeek and #BlackInNature took shape.

The disparity in the access to and use of green space between racialized people and white people is well documented (Rigolon, 2016; Rigolon et al., 2018; Smith et al., 2017; U.S. Department of the Interior, 2006; Wolch et al., 2014), as is the over-representation of white professionals in conservation and EE (Gupta et al., 2019). The events over the summer of 2020 made it more broadly apparent that one reason for these differences is that racialized people, and Black people in particular, do not feel safe or welcome in many natural areas.

While the present research does not examine issues of equity, inclusion, and access, it's worth raising the topic. It's valuable to acknowledge that nature is for everyone, but it's also the case that many of the adaptations made by EE organizations to their programming reflects social distancing challenges as well as attempts to provide better representation and inclusivity. Moving programming online and providing asynchronous activities that can be done closer to home can also improve accessibility for people who are marginalized for a variety of reasons (Kennepohl & Shaw, 2010; Shaw & Carmichael, 2010).

Changing and Adapting

Fortunately, environmental educators are creative and resilient professionals (Gilbert, 2020; Quay et al., 2020; Sutton & Jones, 2020). Many organizations began offering programming online through webinars, collections of resources, social media

campaigns, and citizen science[1] projects like BioBlitz. Despite wide anecdotal evidence, there is little research investigating how, exactly, EE organizations are providing programming or which of those offerings seem to be most successful.

A special issue of *Ecology and Evolution* focused on teaching ecology and evolution online was published in November 2020 (Cotner et al., 2020). In the abstract to the introduction of the issue, the editors describe the content as "includ[ing] a significant component of DIY ecology and evolution that is experiential but done individually, opportunities to use online tools and apps to be more inclusive, student-focused strategies for teaching online, how to reinvent conferences, strategies to retain experiential learning safely, emerging forms of teaching such as citizen science, apps and podcasting, and ideas on how to accommodate ever changing constraints in the college classroom, to name a few." (Lashley et al., 2020). Within the issue, Barton (2020) reports on a survey of field-based ecology and evolution instructors about their online teaching methods. Results showed that most instructors had to substitute the lessons they felt were most important to their classes with less important ones and had an overall negative view of the learning outcomes from the online course experience compared to the field experience. Contrariwise, Main et al. (2020), found that students were just as satisfied with their online master naturalist training course as they had been with in person and hybrid models. Main et al. and others describe case studies of how course content was

1 In recent years, some have expressed concern that use of the work 'citizen' can send a message, particularly in the U.S., that the work is limited to U.S. citizens. The term community science has been replacing citizen science in some organizations. However, due to differing understandings of this term, this thesis will use citizen science to refer to these activities.

adapted. Creech & Shriner (2020) and McKinnon (2020) describe how they transformed the field components of their classes into DIY, at home field work. Haeften et al. (2020) used a citizen science project model for their field-based class. Thompson et al. (2020) created course content that used open scientific data. There are many more examples of innovative adaptions within the issue demonstrating that "...online field course that incorporates direct experience with the natural environment is possible and should no long be considered an oxymoron." (McKinnon, 2020.)

Outside of the special issue of *Ecology and Evolution*, authors provide additional examples of moving outdoor science classes to a virtual model. Mirowsky (2020) wrote about how their sampling methods course was able to convert the lab to remote learning by sending students low cost sampling equipment and having them collect data one their own. Blount et al. (2021) describe how camera traps can be used as a socially distanced tool in conservation research. Van Nuland et al. (2020) provide guidance and tips for choosing e-learning tools for STEM education during the pandemic.

The methods of teaching during the pandemic used by many of these authors could be applied to EE and many likely have been. The evidence for this is largely anecdotal. Four articles provide some insight into what EE organizations are offering. Gilbert (2020) describes how park directors in northern Virginia helped each other create guidelines and messaging in the early days of the pandemic. In Millburn, NJ, Iyengar & Shin (2020) created an environmental education and engagement program that created a bond between the participants and the local environment and a sense of community between participants.

Frequently cited, Quay et al., (2020) collected stories from educators around the world about how the pandemic affected EE and environmental educators. The perspectives offered in the article vary significantly from one another. Many contributors express a positive effect the pandemic has had on EE: an increase in attention to local natural areas and resources. Others echo this and raise concerns about unequal access to nature and environmental justice. A few discuss the opportunity afforded EE by increasing online pedagogy abilities in the field and providing learned another entry point to engaging with the environment. These perspectives are insightful and provide ideas for ways to move forward. They don't provide much information about what kinds of programming are being offered in light of social distancing guidelines or renewed awareness of social justice.

Assaf & Gan (2021) explored how EE organizations have changed their programming during the pandemic in Israel. The researchers interview sixteen educators, most of whom were environmental educators or science teachers. All of the research participants expressed the importance of connecting learners to nature and how lockdown created barriers to facilitating this. However, the participants found other ways of meeting this goal. Some encouraged learners to observe nature through a window or take video and share it. Others realized that technology had the power to connect learners not just to their local environments, but could connect them to environments across the globe. The researchers also asked participants about how things might be different when lockdown ends, to which many participants answered that they were excited to learn outdoors again and expected to continue thinking differently about how they approach teaching.

These studies provide useful insights into ways environmental educators have implemented a variety of programming models. However, there is a lack of information that looks broadly at the ways EE organizations have adapted their programming during the pandemic across the United States or what adaptions have been most successful.

Technology and Education

The literature and anecdotal evidence suggest that a large amount of EE programming has moved online in various forms during the pandemic. While using technology to facilitate environmental engagement may seem counter-intuitive, the research suggests that virtual programming and activities can be effective methods for engaging learners with STEM and the environment.

Online learning, sometimes referred to as distance or remote learning, is not new, to education generally or even to EE. When schools closed across the United States in response to the spread of COVID-19, online learning was new to many teachers and students. The sudden transition was difficult for teachers and learners alike, as well as for parents. Students no longer were receiving immediate feedback from teachers, could no longer contribute the same ways they could in the classroom, and struggled to adjust to virtual and asynchronous lessons (Hebebci et al., 2020). They also missed the social interactions in the classroom and school ground with friends and teachers (Hebebci et al., 2020; Pascal & Bertram, 2021). Students also desired a routine as they had during the regular school year (Pascal & Bertram, 2021) Many suffer from anxiety and stress (Minahan, 2020) and lowered academic motivation (Zaccoletti et al., 2020).

Teachers missed their students and the ability to provide feedback and follow-up (Hebebci et al., 2020; Lassoued et al., 2020). Teachers also noticed decreased student engagement and found online teaching to be challenging and at times frustrating (Hebebci et al., 2020). Systemic and organizational barriers added to teacher frustrations (Lassoued, et al., 2020).

Access to tools and infrastructure have posed problems for both teachers and students (Hebebci et al., 2020; Lassoued et al., 2020). Despite the challenges, many students and teachers found positive aspects to online learning. Both teachers and students agreed that online learning was better than nothing and having even these virtual connections afforded some sense of community and camaraderie (Hebebci et al., 2020). Students and teachers enjoyed that students had more control over how they interacted with the lessons (Hebebci et al., 2020). Pascal & Bertram (2021) found that students enjoyed some flexibility in their routine, despite a desire for structure, as it allowed them more opportunities to go outdoors. Lassoued, et al. (2020) found that students who were involved in extracurricular activities had better academic motivation, indicating that having things outside of school to engage in helped keep them engaged with schoolwork.

A common theme in much of the literature about online learning during the pandemic is the importance of creating community among learners. This theme appears in each of the studies about student and teacher perspectives on online education (Hebebci et al., 2020; Lassoued et al., 2020; Minahan, 2020; Pascal & Bertram, 2021; H. Whitehouse, 2008; Zaccoletti et al., 2020) as well as the literature on different adaptions to online learning (Creech & Shriner, 2020; Gilbert, 2020; Haeften et al., 2020; Iyengar & Shin, 2020; Quay et al., 2020).

This longing for community and camaraderie seems a logical response to the isolation of social distancing and stay-at-home orders. There are ways to build a sense of community using virtual means, including those that relate to EE. Citizen science activities have been shown to increase a person's sense of community (Haywood, 2019; Haywood et al., 2016; Rogers et al., 2010) as have some educational uses of social media (Gao et al., 2012; Hinde et al., 2021).

Asynchronous online learning has benefits in that it allows people to learn on their own schedules and focus on what's personally most important and of interest to them (Rogers & Price, 2008). Those who otherwise couldn't travel to or physically access various locations are able to enjoy those settings (Lewis, 2020). Concerns about safety and weather conditions dissipate for online learning. Further, as EE staff can't be onsite at all hours, online, and asynchronous options can "alleviate staffing pressures at these traditionally low-budget institutions while it can also ensure that visitors are seeing, hearing, and exploring the landscape comparable to how a staff member would if they were physically guiding a family through an environmental education-based program." (McClain, 2016).

Environmental teacher professional development opportunities that take place online can incorporate offline activities that require educators to complete projects in their local, natural environment (Dyment et al., 2018; Li et al., 2016; Moseley et al., 2010; H. Whitehouse, 2008). Many examples of ecology and evolution courses from the *Ecology and Evolution* special issue (Cotner et al., 2020) also employ this online + in situ format. This method of EE allows learners to experience the environment first hand, even if the theoretical lesson takes place online.

Other methods for incorporating technology into EE have also been successful. Formats include virtual field trips (i.e. Lewis, 2020) and nature tours (i.e. Ruchter et al., 2010), mobile apps that provide educational content in a particular place (i.e. Zimmerman & Land, 2014 and McLain & Zimmerman, 2016), social media campaigns (see Greenhow & Lewin, 2016), citizen science activities (i.e. Haeften et al., 2020), and more. Many parks and nature reserves also employ analog informational materials such as brochures and interpretive signs, allowing users to learn about the location without being connected (see Wandersee & Clary, 2007).

Museums have been leading the way in considering the use of technology in informal education. Because field trips can be burdensome for schools, especially those in rural areas, many museums began offering options for distance education (Lewis, 2020). A variety of resources have been made available over the years including curricular materials, digitized collections, and digital exhibits (Lewis, 2020; Mujtaba et al., 2018). These resources bring the museum to the classroom as an online field trip. Mujtaba et al. explored these digital offerings from natural history museums and recommend that, just as physical exhibits are available for prolonged periods, so too should digital exhibits. This allows more users to view the exhibit, incorporate the exhibit into curricula, and is available for learners to explore on their own (Mujtaba et al., 2018).

Museums and other organizations are also increasingly designing and offering immersive virtual field trips using virtual reality. These experiences are more challenging to design and implement, but can yield more deeply engaged learning experiences (Cheng, 2021; Han, 2020). These online experiences and materials not only allow more learners access to the lessons they provide, but also help increase museum attendance by

essentially publicizing collections and educational expertise (O'Leary, 2011). Another way to engage with expertise remotely is to bring -or send- experts into the classroom through video conferencing software. This activity can give learners the benefit of knowledge that experts can provide (Maughan, 2020) and a new understanding of potential future careers (Adedokun et al., 2012).

Online field trips can provide learners access to a variety of environments, including natural environments, when visiting them in person isn't an option. While they remove the element of first-hand learning within nature, they still provide learning experiences that encourage inquiry, communication, construction, and expression (Cassady & Mullen, 2006).

A common use of technology in EE is a mobile app or guide that learners and visitors can use as they explore a natural environment. This use has proven to be quite successful given the right circumstances. Interfaces or apps that are too demanding can distract users from their environment and even more intuitive designs can have a learning curve for users (Rogers et al., 2010). Nevertheless, apps and other mobile tools that facilitate conversation, highlight phenomena or locations of importance, and encourage users to generate or collect new data or knowledge encourage meaningful experiences (Zimmerman & Land, 2014). Fifth graders used iPads on a hike and it helped them engage with the trail (Boyce et al., 2014). Students used the iPads to reference information, collect data, and engage with nature. They wanted to come back to the location. McClain, (2016) and McClain & Zimmerman (2016) created a mobile trail guide for families and children to use on a trail. Researchers found that engagement with the environment tended to have more depth than those without the mobile guide.

A similar study was done by Zimmerman et al. (2015), who observed families using mobile devices in an arboretum. The mobile guide did increase the amount of conversation families had about their environment, but those conversations did not consistently make connections to personal experiences and no long-term learning was measured. Another study gave tours to groups who were given different guides – a brochure, a mobile app, and a human (Ruchter et al., 2010). The researchers found no significant difference between the three methods, suggesting that the mobile app was as effective as the more traditional models for interpretation. Ruchter et al also looked at whether the use of the mobile device created more distraction than the other methods and did not find significant differences in attention.

Zoos and museums also employ mobile technology and much of the research on its use for EE is done in those locations. Yocco et al. (2011) explored what factors influence the use of digital media by examining two case studies. Their results were inconclusive, indicating that new media and technology may be useful for some learners but not all. They also posit that technology and new media may be actively rejected by visitors who seek to 'unplug' from their usually technology-saturated lives. This is useful for planning to integrate technology into EE in that allowing visitors to opt out of using technology can be valuable as well. In museums Knipfer et al. (2009) looked at how mobile technology can facilitate visitor-to-visitor learning through dialog. While dialog may not seem possible in a socially distanced environment, household groups can engage in this method of shared learning and social media can facilitate additional discussions.

Researchers disagree on the usefulness of social media in formal and informal education (Greenhow & Lewin, 2016). However, social media can create a sense of

community (Gao et al., 2012), and this camaraderie can influence positive behavioral changes (Robelia et al., 2011). While little research exists on the effectiveness of social media campaigns as they relate to EE, connecting EE programming to highly publicized social media events like #BlackInNature (Dupree, 2021) and March Mammal Madness (Hinde et al., 2021) can provide a way to engage with learners.

Citizen science is another activity used to engage learners with EE. Some citizen science activities like BioBlitz (National Geographic Society, n.d.) or the Great Backyard Bird Count (National Audubon Society, n.d.) provide a census of species in an area and can be gamified to allow for friendly competitions to see which individual or organization can observe more species than another (Haeften et al., 2020). Peter et al. in their 2019 review of the literature on nature-based citizen science projects, examined 14 papers studying the benefits experienced by citizen science participants. The researchers found that citizen science participants experience gains in knowledge and changed attitudes and behaviors.

Haywood (2019) and Haywood et al. (2016) also found these results and additionally noted that citizen science participation could increase one's connection to place. Hooke-Wood (2020) found that just observing nature without collecting data for citizen science efforts was more effective at instilling a sense of place, but this could be because the data collection wasn't tied to a bigger project. The work done by Sagers (2020) found similar results as those reviewed by Peter et al (2019) that citizen science could instill a connection to place and further tied this place connection to the changes in attitudes and behaviors, as seen by Haywood, 2019, Haywood et al, 2016, and Hooke-Wood, 2020.

Before the spread of COVID-19, Haeften et al., (2020) had planned a partnership with a nearby middle school to develop and contribute to a citizen science project examining the spread of various grass species. The partner organizations considered canceling or postponing the project, but instead adapted it so that the middle school students could participate from their homes. The students were able to learn about the grass species at home on their computers but then had to go outdoors to collect data using either a mobile device or paper form. No assessment of learning was done on this study, but the researchers anecdotally noted that students enjoyed the activity and the middle school coordinator for the project hopes to continue its use in the future.

Technology doesn't provide the only means for providing educational experiences while social distancing guidelines are in place. Long before the current public health crisis, nature centers and parks have provided interpretive signs, maps, and brochures for visitors. Much of the research on these analog methods of information dissemination focuses on signage and the majority comes from zoos. The research on zoo signage shows that signage is effective when visitors actually read them (Waller et al., 2012). Reasons for not reading signs include old, faded, illegible signs and crowds blocking access to them (Roe et al., 2014). Signs that offer an interactive element such as a game increase interaction by visitors (J. Whitehouse et al., 2014). One study looked specifically at trail signs in an arboretum and focused on how the signs were designed (Wandersee & Clary, 2007). The authors recommend that signs be no longer than 70 words, have a conversational tone, be one topic per sign, and provide graphics or other visuals, among other recommendations.

Conclusion

There is a great deal of research available outlining various ways to provide virtual, asynchronous, and self-guided informal educational experiences. Much of this research has been done by museums and, to a lesser extent, zoos, and their findings can largely be applied to informal EE. Many reports of these methods for EE are singular case studies or recommendations for design. More research on what works for learners in informal EE has been carried out through nontraditional methods. These studies are effective at providing a picture of what kinds of programming is and might be offered in lieu of the usual EE programming, but there has not been comprehensive survey of organizations or explored which of these programs have been successful. Therefore, this thesis will explore the questions: *How did organizations alter and adapt their programming to meet public health guidelines during the pandemic?* and *What successes and challenges did organizations face in offering these programs?*

In the next chapter, the methods used to research how EE organizations adapted their programming during the pandemic and which adaptions were most successful will be discussed. To fill this gap in the literature, the present study used a mixed methods approach to understand the EE programs that have been offered during the first year of the pandemic. A survey was distributed to EE professionals about how their programming was changed under social distancing guidelines and stay at home orders. The survey also asks about what changes were successful and what factors influenced that success. These questions are important to the field because they not only provide an understanding of environmental educator resilience and creativity, but also because they provide insights

into a wider breadth of options for delivering EE content as the pandemic continues, and as organizations rebound after the financial impacts it has wrought.

CHAPTER THREE

Methods

Introduction

The COVID-19 pandemic brought with it social distancing guidelines and stay-at-home orders that caused the field of education to use different methods for teaching. Informal environmental education was no exception. Programs offered by EE organizations had to be canceled, adapted, or rethought to respond to these recommendations and to account for budgetary and staffing issues additionally brought about by the pandemic (Erdody, 2020; Rendon, 2021).

The present research seeks to learn what types of programming EE organizations offered during the pandemic and which of these programs were most successful.

Theoretical Framework

This study uses a mixed methods approach of qualitative open-ended questions and quantitative closed-ended questions (Creswell & Creswell, 2015) to understand the EE programs that have been offered during the first year of the pandemic. A survey was distributed to EE professionals about how their programming was changed under social distancing guidelines and stay at home orders (independent variable). The survey also asks about what changes were successful (dependent variable).

From the emerging literature on pandemic education and anecdotal observations of EE programs taking place during the pandemic, it's expected that much of the programming is being offered online. Online education is well-researched and success

factors can be predicted from understanding the literature on the topic. Learning about the successful EE programs offered during the pandemic is important to the field because it not only provides an understanding of environmental educator resilience and creativity, but also because it provides options for delivering EE content as the pandemic continues and as organizations recover from financial impacts brought on by the crisis.

Participants and Setting

A survey was distributed to people who work or volunteer for an organization that provides informal or non-formal environmental education programming or opportunities. Here, programming refers to any activities or events that instruct, inform, or engage audiences with any environmental topic. The survey was advertised on the North American Association for Environmental Education's Opportunities board (NAAEE, n.d.) which allowed participants to self-select as appropriate participants.

The survey was also distributed through multi-stage sampling (Creswell & Crewell, 2015) to the listed contact information at identified qualifying organizations. These organizations were identified with the help of listings of nature centers ("List of Nature Centers in the United States", 2021) and science museums ("List of Science Centers in the United States", 2021) by state and the list of accredited Association of Zoos and Aquariums facilities from Wikipedia ("Association of Zoos and Aquariums", 2021) and contact information was found on the organizations' websites. Email contacts for staff in educational positions were prioritized, with general email addresses included when such information was not provided. Organizations with no available email address were excluded.

Materials

The survey was designed using Qualtrics software and contains demographic questions about the organization's location (rural, urban, or suburban; state), financial sector (non-profit, government, or for-profit), type (nature or environmental learning center, zoo or aquarium, museum, or park or park system). Participants are also asked which audiences their organization reaches (pre-K-12 students, adult learners, families, the general public, senior citizens, scouts or youth groups, homeschool children) and which types of programming their organization typically offers (field trips, summer camps, onsite preschool, master naturalist or gardener trainings, public education programs, guided nature walks or tours, community programs, service learning, volunteer opportunities, or other programs).

Questions about programming during the COVID-19 pandemic include those about which programs were altered or cancelled due to the pandemic, what types of programming was offered (synchronous or asynchronous virtual programs, self-guided walks or tours, take home kits, citizen science programs, scavenger hunts or geocaching activities, social media campaigns, or other programs), which programs offered were most and least successful and what factors impacted these successes or failures. Participants are also asked about potential gains or losses that learners experienced due to these changes and new programs and asked if any of these programs will continue when public health restrictions are lifted. See Appendix A for the entire survey instrument.

Data Collection

The survey was posted to the NAAEE Opportunities board on June 9, 2021. Emails were sent to identified organizations on June 21, 2021 using Qualtrics Distribution feature with anonymous links to the survey. Reminder emails were sent one week later on June 28, 2021. The survey closed on July 5, 2021 at which time all incomplete surveys were recorded.

Analysis

Three groups of open-ended questions are asked: factors participants feel influenced those program success or failure, perceived gains or losses for learners, and what programs will continue post-pandemic. Analysis of this qualitative data will employ grounded theory and two-cycle coding methods (Miles & Huberman, 1994; Saldaña, 2021). In the first cycle, descriptive coding of the data will take place. After codes are assigned to the responses, those codes will be reviewed in context and synthesized into categories that will allow themes to emerge (Saldaña, 2021).

Ethics

This study has been reviewed by Hamline University's Institutional Review Board and considered not to be human subjects research. The research was conducted according to ethical standards. Data was collected using a secure software and accessible only to the researcher throughout its analysis. Data has been de-identified and aggregated before being made available for further research.

Conclusion

The survey questions provided both qualitative and quantitative data about the educational programming offered during the pandemic and about how successful those programs were. This data provides a glimpse at the breadth of programming formats offered and offers insights into which types of programming could benefit EE organizations going forward.

The findings of this research are described in the next chapter.

CHAPTER FOUR

Results

Introduction

A survey was distributed to environmental education organizations to find answers to the questions: *How did organizations alter and adapt their programming to meet public health guidelines during the pandemic?* and *What successes and challenges did organizations face in offering these programs?* The responses to the survey reinforce the expectation that many organizations that provide environmental education adapted many of their program offerings to a virtual format. Unexpectedly, many organizations additionally reported offering in-person programs that were altered to meet public health guidelines. Both the virtual, analog, and in-person programs described by the respondents showed enormous creativity, determination, and a strong dedication to their learning communities from the people who carried out these changes.

Demographics

The survey was posted on the NAAEE Opportunities board (North American Association of Environmental Education, n.d.) and sent to 1270 identified contacts at nature centers, museums, and zoos. 301 people began the survey and 258 completed it, providing a 20% response rate. One person did not agree to the terms of participation. 41 participants responded that they provided no programming during the pandemic and consequently could not respond to questions about which programs were most or least

successful. These participants were asked about the challenges they faced in offering programs.

Respondents reported from 45 U.S. states, with Arizona, North Dakota, South Dakota, West Virginia, and Wyoming not represented. The states with highest representation were Michigan (8.9%), Pennsylvania (7.79%), and Wisconsin (6.97%). Most states had 1-5 participants with an average of 4.6 respondents per state.

Just over half of respondents (53.79%) describe their organization as a nature or environmental learning center (see Table 1). 13.36% describe their organization as a park or park system, 12.64% as a zoo or aquarium, 9.75% as a museum, and 10.47% selected other. Those that selected other described their organization as a botanical garden, wildlife refuge or preserve, research center, a combination of the choices given, or another government, conservation, or educational organization.

Table 1

Q3 Which of the following best describes your organization?

Organization Type	Count	Percent
Nature or environmental learning center	149	53.79
Park or park system	37	13.36
Zoo or aquarium	35	12.64
Other (please describe)	29	10.47
Museum	27	9.75
Total	277	100

Over half (58.27%) of respondents were reporting from nonprofit organizations and 39.21% from public or government organizations (see Table 2). Only 2 (0.72%) described their organization as for-profit and 5 (1.8%) described their organization as another type, three of which said their funding was tied to a university and two reporting a combination of non-profit and government or public funding sources.

Table 2

Q4 Financial type of organizations

Type	Count	Percent
Nonprofit organization	162	58.27
Public or government organization	109	39.21
Other (please describe)	5	1.80
For profit organization	2	0.72
Total	278	100

There was a nearly even split in the reported locations of respondent organizations (see Table 3). 35.51% reported being in rural areas, 31.88% in suburban areas, and 27.9% in urban areas. The 4.71% who responded with other reported having multiple locations, being at the intersection of two or more given location options, being in small cities or college towns, or on islands.

Table 3

Q5 Which of these best describes where your organization is located?

Locations	Count	Percent
Rural area	98	35.51
Suburban area	88	31.88
Urban area	77	27.90
Other (please describe)	13	4.71
Total	276	100

Over three quarters of respondents reported reaching nearly all of the audiences provided in the survey, with higher education students being the only audience reached by fewer organizations than that (59.35%) (see Table 4). Children in grades 1-5 are the most commonly reached group (98.2%), followed by school groups (97.12%), families (95.68%), the general public (94.24%), and children in pre-K or kindergarten (91.01%). Children in grades 6-8 are reached by 89.21% of respondents and high school students by 76.26%. Adults are reached by 89.21% of respondents and senior citizens by 75.18%. 83.45% of respondents reach scouts or youth groups. Of the 7.19% of respondents who reach other audiences, specialized clubs, groups and camps were most common, while others reach individuals with disabilities, school and pre-service teachers, or professionals at non-profit or governmental organizations.

Table 4

Q6 What audiences does your organization's programs reach? Select all the apply.

Audience	Count	Percent
Children in grades 1-5	273	98.20
School groups	270	97.12
Families	266	95.68
General public	262	94.24
Children in pre-k or kindergarten	253	91.01
Children in grades 6-8	248	89.21
Adults	248	89.21
Home school children	236	84.89
Scouts or Youth Groups	232	83.45
High school-aged children	212	76.26
Senior citizens	209	75.18
Higher education students	165	59.35
Other, please describe	20	7.19
Total	2894	

Programs Offered, Cancelled, Altered

The most common programs typically offered by responding organizations included field trips (91.73%), public education programs (89.93%), and volunteer opportunities (89.93%) (see Table 5). The next most commonly selected options were guided nature walks or tours (79.86%), summer camp (70.5%), and community programs (67.63%). Almost ten percent (9.71%) of respondents reported offering onsite preschool and nearly double that (18.35%) offer master naturalist or gardener training. Just under a third of respondents (30.58%) offer service learning. Respondents who reported other

programming types (8.99%) indicated they typically offer professional development opportunities, outreach, drop-in educational events, speaker series and lectures, workshops, citizen or community science activities, non-camp summer programming, onsite elementary schooling, internship opportunities, afterschool programs, research, roving interpretation, live animal presentations, and virtual and off-site programming.

Table 5

Q7 What types of programming does your organization typically provide? Select all that apply.

Program type	Count	Percent
Field trips	255	91.73
Public education programs	250	89.93
Volunteer opportunities	250	89.93
Guided nature walks or tours	222	79.86
Summer camp	196	70.50
Community programs	188	67.63
Service learning	85	30.58
Master Naturalist or Gardener training	51	18.35
Onsite preschool	27	9.71
Other, please describe	25	8.99
Total	1549	

As expected, many organizations reported needing to alter (99.58%) or cancel (98.31) many of their programs during the COVID-19 pandemic. The counts and percentages of respondents who altered or cancelled different programs can be viewed in Tables 6, while Table 7 shows the comparison of each program type that was altered or

cancelled as a percentage of respondents who indicated they offered those program types typically.

Table 6

Q10 Which programs did you cancel? and Q12 Which programs did you alter? Select all the apply.

Program type	Altered		Cancelled	
	Count	Percent	Count	Percent
Field trips	137	59.05	198	86.46
Summer camp	122	52.59	99	43.23
Onsite preschool	17	7.33	13	5.68
Master Naturalist/Gardener training	16	6.90	17	7.42
Public education programs	180	77.59	156	68.12
Guided nature walks or tours	112	48.28	122	53.28
Community programs	106	45.69	109	47.60
Service learning	21	9.05	51	22.27
Volunteer opportunities	112	48.28	152	66.38
Other, please describe	18	7.76	6	2.62
Total	841		923	

Table 7

Comparison of cancelled and altered programs

Program type	Percent Altered	Percent Cancelled
Field trips	63.13	92.09
Service learning	29.58	76.12
Public education programs	86.54	76.10
Volunteer opportunities	53.08	76.00
Community programs	66.25	72.67
Guided nature walks or tours	60.22	66.67
Onsite preschool	73.91	59.09
Summer camp	71.76	58.58
Master Naturalist or Gardener training	44.44	50.00
Other, please describe	85.71	30.00

Note. Percentages were calculated by comparing counts of cancelled to counts offered. This calculation corrects for respondents who responded to Q7 (offered) but not Q10 (cancelled) or Q12 (altered).

Pandemic Programming

Many programs offered during the pandemic took on a virtual component. 68.35% of respondents reported offering synchronous virtual education programs (online activities done live) and 58.63% reported offering asynchronous virtual educational materials (activities learners could do on their own time) (see Table 8). 47.12% of respondents offered programming in the form of social media campaigns. Respondents additionally offered self-guided walks (39.57%), scavenger hunts or geocaching activities (38.13%), take-home kits (33.81%), and citizen science projects (26.26%). Nearly a fifth of respondents (19.78%) reported offering other programs including in-person, outdoor activities with smaller groups and mask requirements, video presentations, blogs and

newsletters, virtual festivals and camps, and a variety of additional innovative programs. A full list of the programs described as *other programs offered during the pandemic* can be found in Appendix B.

Table 8

Q13 What type of programming did your organization offer during the first year of the COVID-19 Pandemic? Select all the apply.

Program type	Count	Percent
Synchronous virtual educational programs (ie webinars)	190	68.35
Asynchronous virtual educational materials (ie activity ideas listed on websites)	163	58.63
Social media campaigns	131	47.12
Self-guided walks	110	39.57
Scavenger hunts or geocaching activities	106	38.13
Take-home nature kits	94	33.81
Citizen science projects	73	26.26
Other, please describe	55	19.78
Total	922	

Successes and Failures

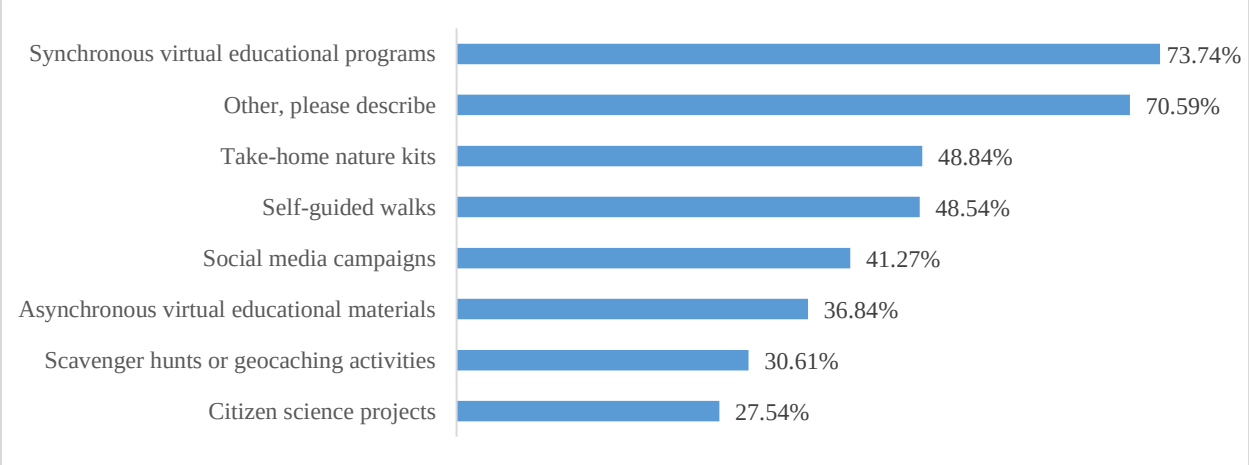
There are a wide variety of ways that programs may be defined as successful including high attendance rates, strong learner engagement, or demonstrated gains in knowledge or changes in behaviors. This survey did not seek to define success for participants and left the interpretation of the question up to each respondent.

The most common response for most successful programs were synchronous virtual educational programs (73.74%) and Other (70.59%) (see Figure 1). Within the

Other category, 71.43% indicated that their most successful programs were those which involved direct interaction with other people and 68.57% of these programs happened live.

Figure 1

Q14 Which programs do you think were most successful? Select all that apply.



The most common program type reported as least successful were asynchronous virtual educational materials (53.33%) (see Figure 2). These results align with the many studies showing the value of community and connection during the pandemic. Curiously, interaction with others was mentioned by just 3.55% of respondents as a success factor for these programs and direct interaction with educators (7.61%) and the interactivity of the programs (4.06%) were reported with similar infrequency. Creating a sense of community was not mentioned at all in the responses about success factors.

Figure 2

Q16 - Which programs do you think were least successful? Select all that apply.

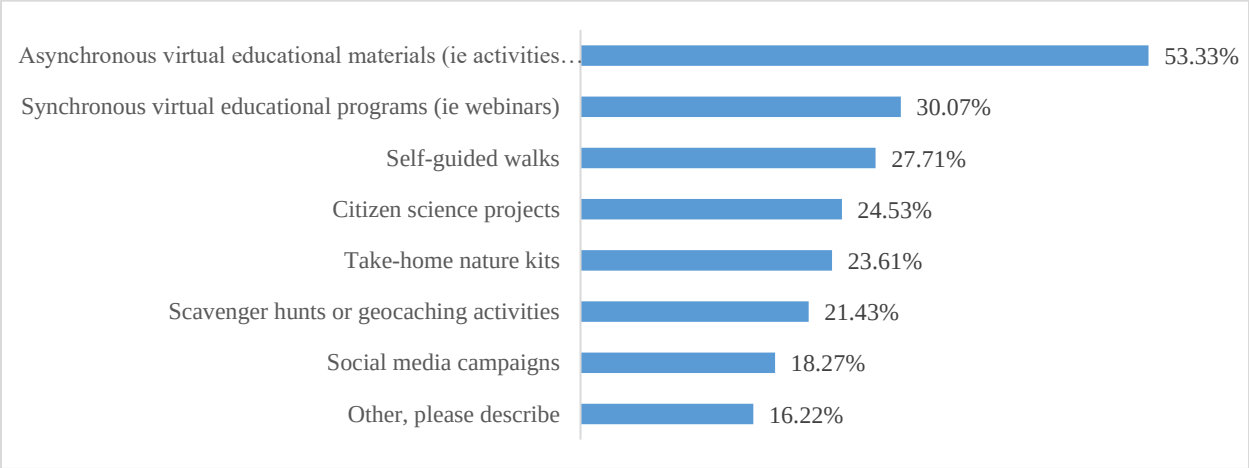


Table 9 shows a comparison of what types of programs respondents indicated were most and least successful.

Table 9

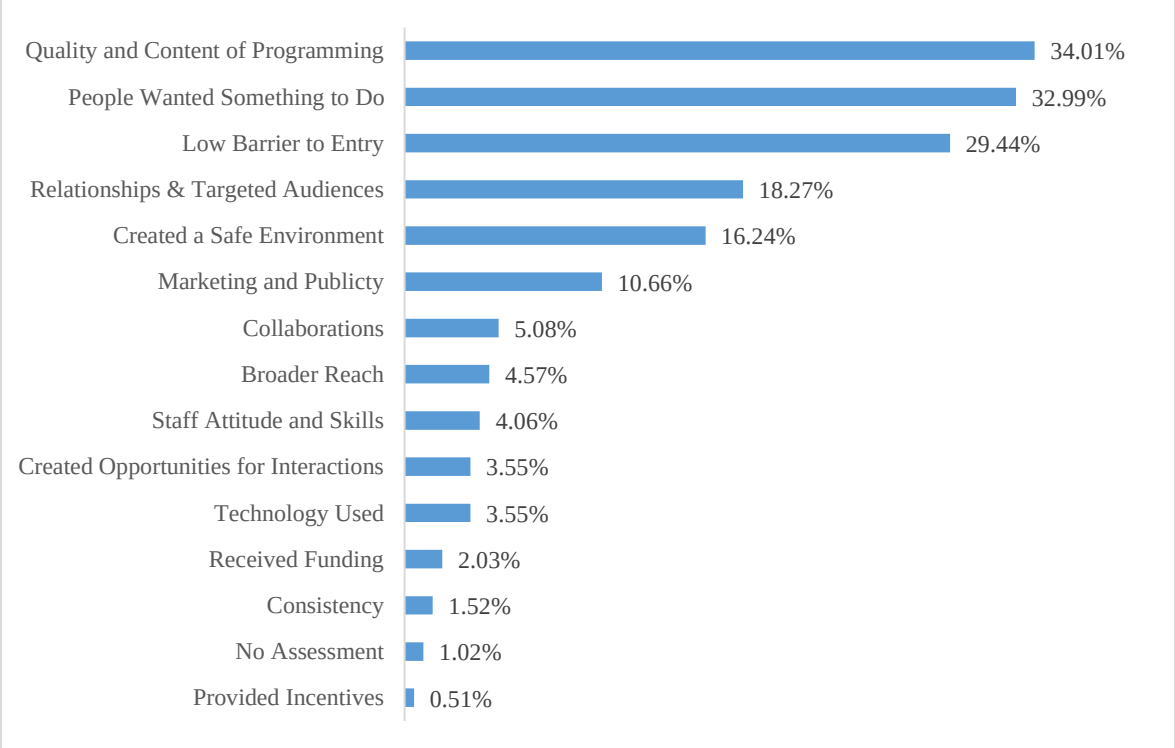
Q14 & Q16 Most and least successful programs

Program type	Most Successful	Least Successful
Synchronous virtual educational programs (ie webinars)	73.74%	30.07%
Other, please describe	70.59%	16.22%
Take-home nature kits	48.84%	23.61%
Self-guided walks	48.54%	27.71%
Social media campaigns	41.27%	18.27%
Asynchronous virtual educational materials (ie activities ideas listed on websites)	36.84%	53.33%
Scavenger hunts or geocaching activities	30.61%	21.43%
Citizen science projects	27.54%	24.53%

The top three themes that emerged in factors respondents felt contributed to the success of programs were the quality and content of programming (34.01%), people wanting something to do (32.99%) and low barriers to entry (29.44%). Pre-existing relationships and targeted audiences (18.27%) and creating a safe environment (16.24%) were the next most common factors for success according to respondents.

Figure 3

Q15 What do you think contributed to the success of those programs?

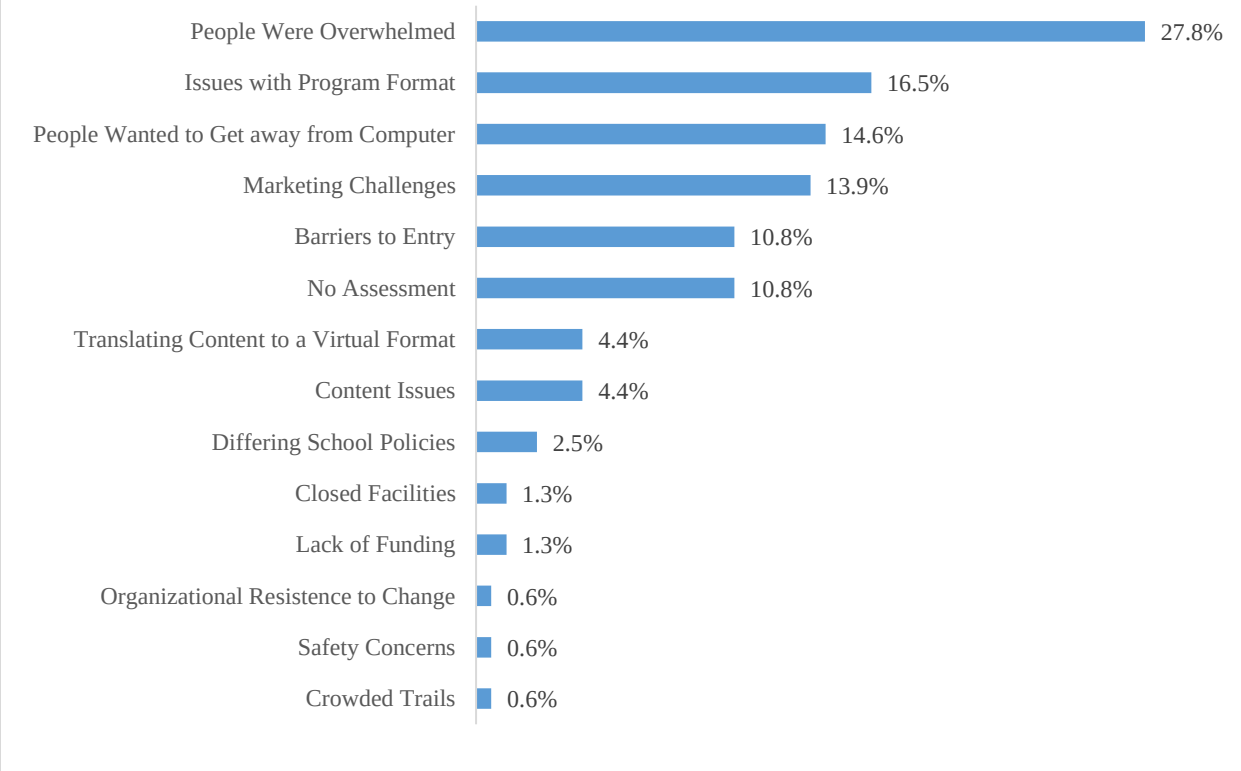


Responses about what caused some programs to be less successful tended to be more varied than factors for success and more respondents noted in these responses that they lacked sufficient assessment methods (10.76%) (see Figure 3). The saturation of

virtual, mostly asynchronous content and the general feeling that teachers and parents were overwhelmed were the primary factors (27.85%) respondents felt hindered success of some programs. Respondents additionally noted that their programs were perhaps too long or too infrequent, or lacked enough guidance or direction from, or interaction with staff. These and other issues with the program format were also commonly reported (16.5%) hindrances.

Figure 4

Q17 What do you think hindered the success of those programs?



Factors that can make or break program success include marketing and publicity and having sufficient funding. Having good relationships with the community, volunteers,

members, and other organizations can also help programs succeed. One respondent noted that collaborating with other local organizations to distribute DIY kits to learners increased the success of that program, while others commented that not having a robust method for distributing kits or finding themselves in competition with other local organizations who had similar kits led to fewer people using their kits.

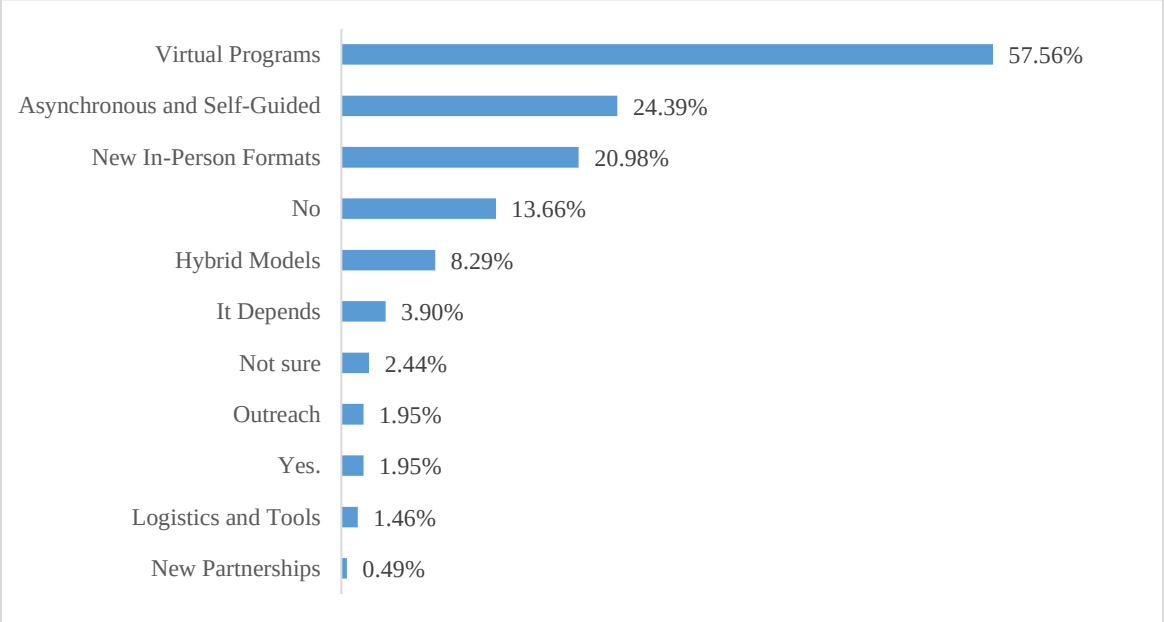
Respondents also suggest that the technology chosen to deliver programming can have an impact on its success. Using tools that the staff and the learners are already familiar with or that provide a useful service can help set the program up for success. Conversely, using technology that is new to users or relies on a stronger internet connection than the organization or the learning community has access to can limit the success of the program.

Future Offerings

Most organizations (80%) reported that some of the programs offered during the pandemic could continue to be offered after public health restrictions have been lifted (see Figure 4). Only 13.66% indicated that they are not going to continue any of their pandemic programming and 6.34% expressed uncertainty (*Not Sure*, 2.44% and *It Depends*, 3.90%) about whether these programs will continue.

Figure 5

Q21 Do you anticipate continuing any of the programming you offered during the pandemic once social distancing guidelines are lifted?



A few the respondents who indicated they would be continuing programs offered during the pandemic provided reasoning behind this decision. For some, the pandemic had caused the organization to rethink their programming for the first time in years and through that process they found new, better ways to offer programs. For others, they recognized that their virtual programs were being accessed by people much further away than their usual audiences and they want to continue those relationships and offer these options for lower income schools and individuals who can't travel to their location. For still others the virtual programming will serve to provide options for programs during inclement weather.

For the majority of respondents who indicated they would continue to offer at least some of their pandemic programming, most (57.56%) said they would continue virtual programs, with 34.6% keeping their response limited to this wording (see Table 9). Others noted continuing live-stream programs (8.8%), virtual field trips (6.8%), social media events (3.9%), virtual speakers (2%), and virtual professional development opportunities (1.5%).

Just under a quarter (24.39%) of respondents indicated that they would continue asynchronous or self-guided programs. These included self-guided online activities and tours or hike (5.85% each), pre-recorded videos (4.88%), take-home or DIY kits (4.88%), scavenger hunts (1.46%), and citizen science activities (1.46%).

Table 10

Virtual and asynchronous and self-guided programs organizations plan to continue

Virtual Programs	
Program	Percent
General Virtual Programs	34.63%
Live-Stream Programs	8.78%
Virtual Field Trips	6.83%
Social Media Events	3.90%
Virtual Speakers	1.95%
Virtual Professional Development Classes	1.46%

Asynchronous and Self-Guided Programs	
Program	Percent
Self-Guided Online Activities	5.85%
Self-Guided Tours/Hikes	5.85%
Pre-Recorded Videos	4.88%
DIY Activities	4.88%
Scavenger Hunts	1.46%
Citizen Science Activities	1.46%

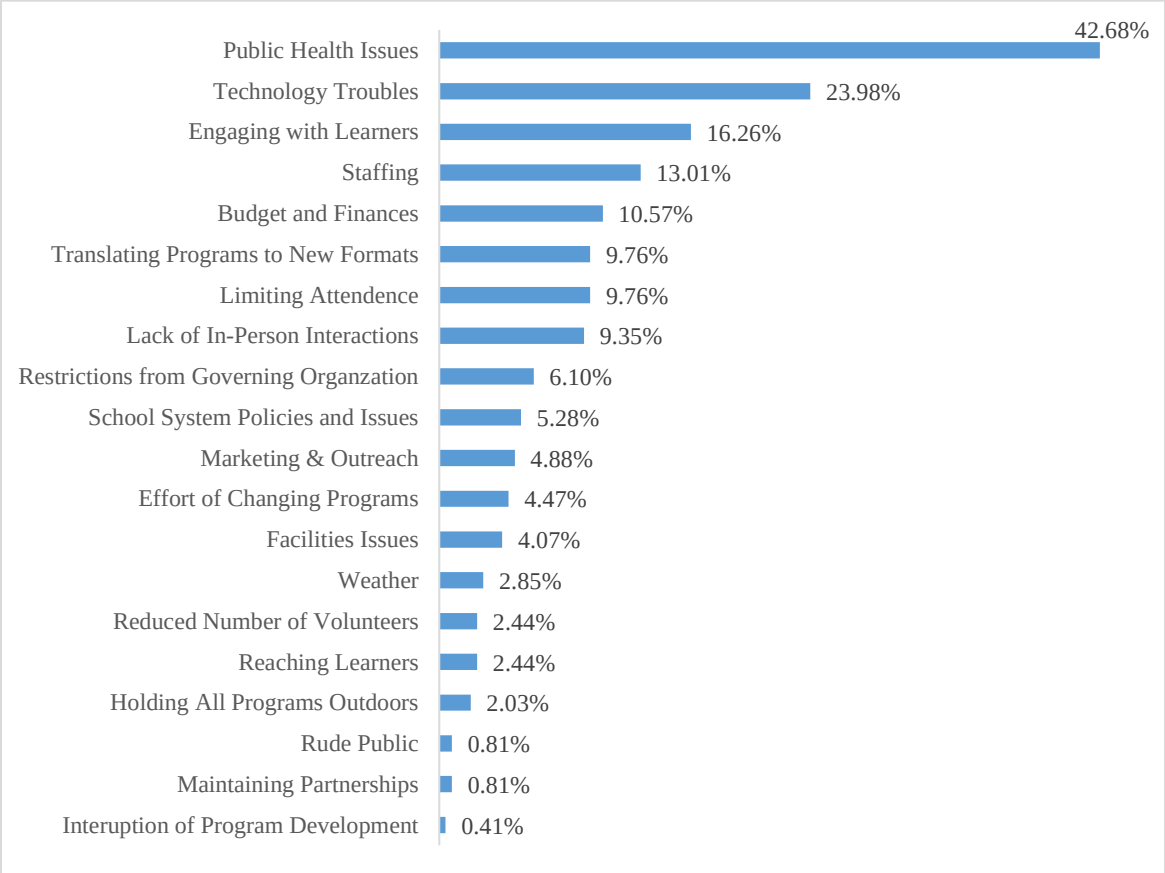
Just over a fifth (20.98%) of respondents said they would be continuing formats for in-person programming that were implemented during the pandemic. These included specific in-person program offerings that had been created (18.05%) as well as holding more programs outdoors (2.93%)

Biggest Challenges

Nearly half of respondents (42.68%) noted that some aspect of the public health crisis posed the biggest challenges (see Figure 5). These included the logistics of maintaining safe environments through sanitation practices and social distancing (23.58%) and staying current on the seemingly ever-changing- and at time conflicting –public health guidance coming from governing organizations (12.60%). Some organizations struggled with ensuring the public adhered to these guidelines (2.03%).

Figure 6

Q18 What have been the biggest challenges in offering programs during the pandemic?



Many of the factors that respondents felt hindered the success of programs are echoed in the responses to Q18 *What have been the biggest challenges in offering programs during the pandemic?* Technology troubles caused some of the greatest challenges for nearly a fourth of respondents (23.98%). These ranged from general technology issues (6.50%), the learning curve associated with learning new technology (10.98%), and having limited access to technology needed to provide virtual programs

(6.50%). These are also barriers in online learning environments noted by Hebebci et al., 2020; and Lassoued et al., 2020.

Another challenge reported by 16.26% of respondents was engaging with learners. For many of these respondents, engaging with learners virtually was the main challenge (6.91%). Other respondents struggled to generate ideas for programs (6.50%) and respond to users changing interests and needs (2.44%).

Staffing (13.01%) and financial issues (10.57%) also were a major challenge for many respondents. This is unfortunately expected given the reports from Collins et al., 2020 as well as Erdody, 2020 and Rendon 2021. In addition to losing staff due to furloughs, layoffs, and resignations, some organizations (2.44%) had decreased numbers of volunteers, who they regularly depend on for support.

The mental and emotional strain of living and working through a pandemic was also a challenge for some respondents (4.47%). Literature that has emerged during the present study highlights the impact the pandemic has had on teacher mental health (i.e. Baker et al., 2021 and Kim et al., 2021). These effects are likely also impacted by educators missing the in-person interactions with their students (Hebebci et al., 2020). These challenges are seen in 9.35% of responses to Q18 as well.

It’s difficult to say with certainty whether these challenges were the only challenges faced by respondents or whether they indicated, as the question asked, only their biggest challenges. It is possible that respondents experienced many of these challenges but didn’t not feel the weight of some warrant inclusion in their responses to this question.

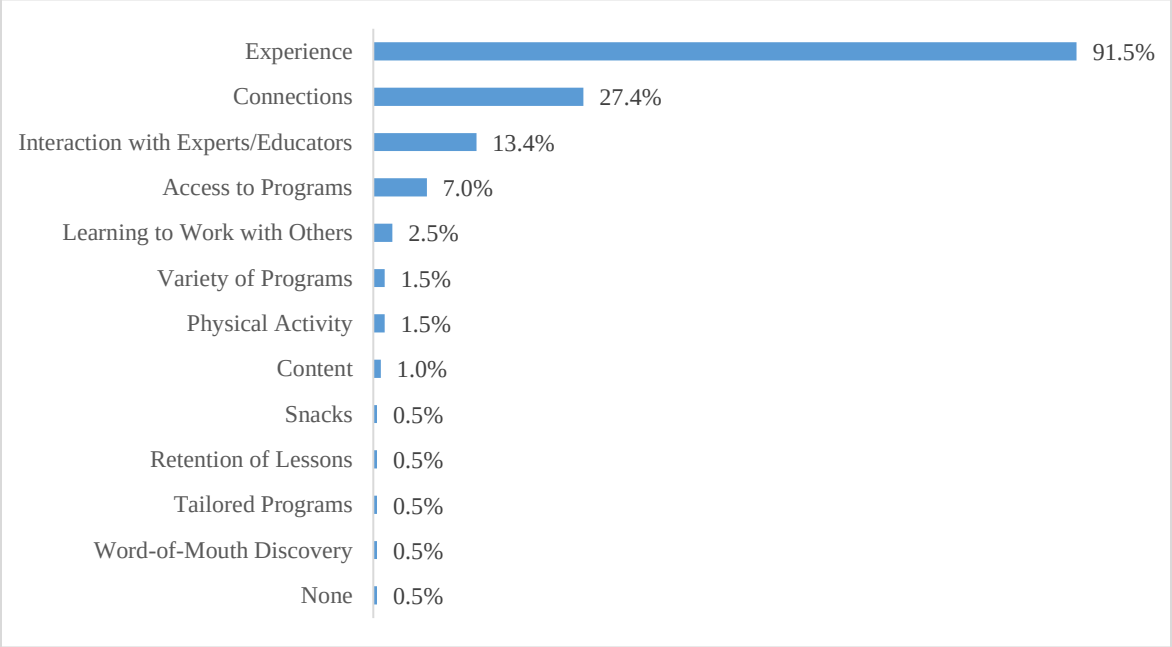
Gains and Losses

In addition to the challenges faced by organizations, participants were asked about what they felt learners missed out on because of the changes they made to their programs. Overwhelmingly, 91.54% of respondents felt that learners missed out on the first-hand experiences afforded by being in nature (21.39%), attending a field trip (14.43%) or camp (3.98%), participating in hands-on activities (25.37%), and experiential learning generally (26.37%). Certainly, these activities are important for young learners especially (Dankiw et al., 2020; Gill, 2014; Holland et al., 2018; Mann et al., 2021; Mygind et al., 2019; Tillmann et al., 2018).

Respondents also felt that learners lost connections to wildlife (7.46%), to place (3.48%), and to each other (16.42%). For respondents whose organizations had cancelled many programs or cap attendance to meet public health guidelines, learners lost access to the programs typically offered (6.97%).

Figure 7

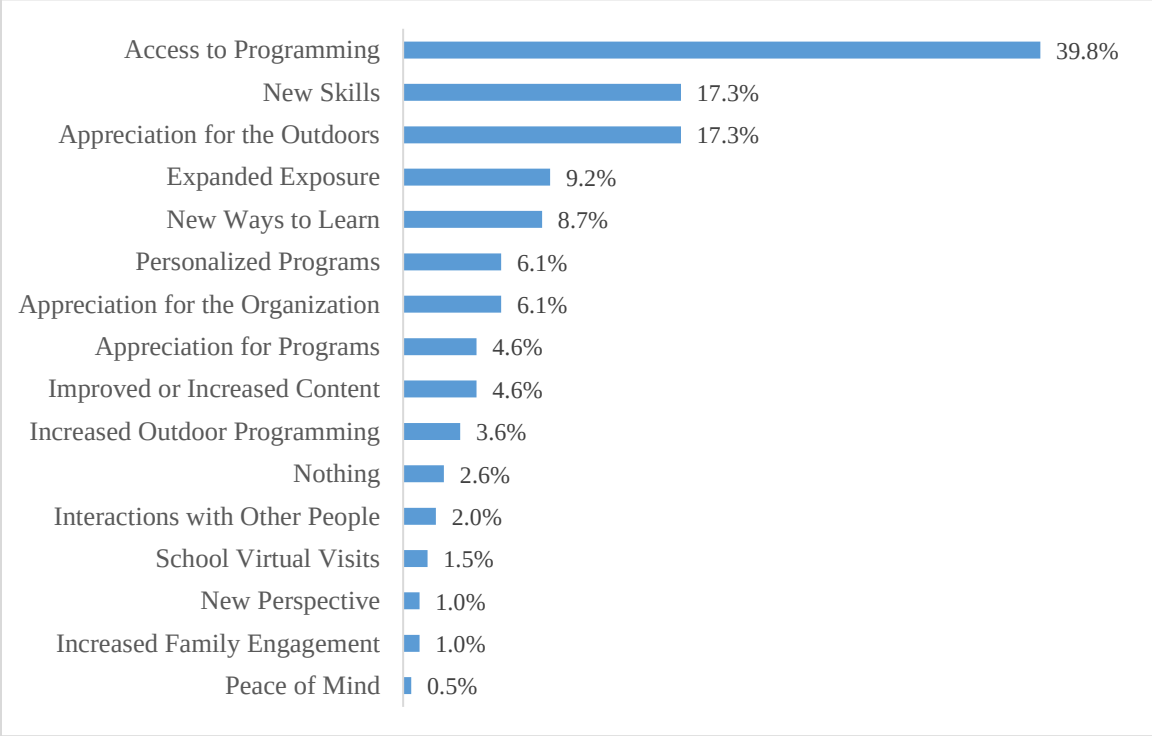
Q19 What, if anything, do you think learners missed out on because you had to cancel or make changes to your programming during the first year of the COVID-19 pandemic?



To balance this question, participants were also asked if they felt the changes to their programs were beneficial for learners in anyways. Most respondents (39.80%) noted that their virtual programs were able to reach more people than they normally would (see Figure 9), providing expanded access to EE. This benefit of expanded access to information due to online learning is noted in Quay et al., 2020, Lewis, 2020, Keppepohl & Shaw, 2010, and Shaw & Carmichael, 2010.

Figure 8

Q20 What, if anything, do you think learners gained from the changes to your programming?



Many respondents (17.35%) noted the new skills that learners gained through their pandemic programming. These include resilience (6.63%), flexibility (3.06%), patience (1.02%), new ways to interact with other (2.55%), how to ask better questions (0.51%), and, of course, new technology skills (3.57%).

Respondents also reported that learners gained an appreciation for the programs they offer (4.59%), the organization (6.12%) and for the outdoors (17.35%), including a connection to place (1.02%). An increase in outdoor programming was considered a positive impact on programming for learners by 3.57% of respondents and the ability to

show places and animals that are normally off-limits to learners through virtual programs was a benefit reported by 9.18% of respondents.

Summary of Findings

The results of this study provide a snapshot of what kinds of environmental education programming has been offered during the COVID-19 pandemic in 2020 and into 2021. As predicted, many organizations had to alter or cancel a number of their typical programs and many employed online programming to continue to educate and engage with their audiences.

What was not anticipated was the large number of organizations who would report that they offered in-person programming with adjustments made to meet public health guidelines and keep their learners and staff safe. This finding and the details about programs offered in Appendix B will no doubt be of interest to EE organizations who can apply these programs and methods to their own programming.

The challenges reported by respondents echo those found in the literature about financial burdens and revenue loss (Collins, et al., 2020; Erdody, 2020; Rendon, 2021) and challenges of online learning (Hebebci et al., 2020). Revenue loss, limited staffing, difficulty in continued engagement, and a generally longing for in-person interactions were felt by many participants in this study.

The next chapter will further discuss the implication of these findings, the limitations of this study, and potential future directions for this research.

CHAPTER FIVE

Discussion

Introduction

The previous chapter reviewed the results of the survey designed to answer the questions: *How did organizations alter and adapt their programming to meet public health guidelines during the pandemic?* and *What successes and challenges did organizations face in offering these programs?* This chapter will discuss the limitations of the study, what applications the results have for the environmental education field, and future directions for research.

The results of this survey definitely show the hardships faced by EE organizations in offering programs during the COVID-19 pandemic. They also highlight the adaptability of environmental educators. Many organizations were still able to provide educational programming online and in-person, both live and asynchronously. These programs offered content for teachers and parents struggling to keep their students and children engaged, things for people of all ages to do safely from home or outdoors, and an excuse to get safely out of the house to enjoy the natural world. Respondents reported several unexpected silver-linings of the pandemic, but as one participant noted and many clearly felt, they "never want to do this again."

Limitations of this Study

There were three main limitations to this study. Firstly, the timeline for completion of the research was accelerated for the Summer session. This resulted in only

one month for data collection, including collection of contact information for participants. A longer window for data collection would have produced more responses. In addition to the abbreviated time for data collection, there was limited time for analysis of the results. Consequently, two survey questions- *Q22 What else would you like us to know about your programming during the COVID-19 Pandemic?* and *Q23 What is your organization's mission statement?* –that were not able to be analyzed as part of this thesis.

Collecting data during the summer months also posed limitation on recruiting participants, as summer is the busiest time of year for many organizations that provide EE. I receive multiple responses via email that the contact would not be able to complete the survey due to their schedule. Others were out of office during the data collection period. Collecting data about an ongoing pandemic is additionally challenging because there are so many unknowns for the target organizations. Not only are there ongoing uncertainty, but the mental capacity of much of the population, and teachers especially, is limited.

Finally, the data collected is all based on perceptions and beliefs of participants. Particularly the questions about factors that contributed to or hindered the success of programs is based on their professional opinion and not empirical data or rigorous assessment techniques.

Applications

The response rate was fair and the respondents provided useful information that can likely be applied to large number of similar organizations. The goal of this survey was to

find out what types of programs have been offered and not to identify exact recommendations for EE organizations. As noted in Yocco et al. (2011), some learners will do well with online options, while others will reject it. Pairing the information gained from this study with knowledge about an organization's community and audience will help EE professionals make decisions about what types of programs may be worth attempting.

Successes and Failures

The information that will be of particular interest to environmental professionals is the data collected about what pandemic-era programs were most and least successful, and the factors that contributed to those outcomes. These data are based on the participant's professional opinion rather than data, but there are valuable insights to be gleaned from the information provided. As discussed in the previous chapter, the programs reported most successful tend to support the work of Iyengar & Shaw, 2020, Quay et al., 2020, Hebebci et al., 2020, Minahan, 2020, Zaccoletti et al., 2020, and Pascal & Bertram, 2021 – all of whom note the importance of social interaction and community on online and pandemic learning.

In addition to the contributions to and hindrances from success, the information collected about what learners gained or lost due to pandemic programming changes provide interesting insights into the benefits of EE in a pandemic era. These can be mapped to the outcomes for EE as defined in the Tblisi Declaration (UNESCO & UNEP, 1978). By referring to Table 10 and adjusting for their own programs, organizations may be able to determine what types of programs they need to achieve all five outcomes.

Table 11

Pandemic programming and EE outcomes

Outcome	Gain	Loss
Awareness	Access, Appreciation for Organization, Desire for Something to Do, Desire to Be Outside	Word-of-Mouth Discovery, Closed Facilities
Knowledge	Access to Programs, Expanded Exposure, Interactions with Educators	Content from Programs Not Offered, Retention of Hands-On Experience
Attitudes	Appreciation for Outdoors, New Perspectives	
Skills		Hands-On Experiences, Experiential Learning
Participation	Increased Family Involvement	

New Ways to Learn, New Ways to Teach

Another area of interest in the results is what programs organizations are planning to continue offering. Most respondents will continue some of their pandemic programs or formats going forward. The survey did not ask for reasons for continuing these programs, but some respondents provided this information. For virtual programs, in particular, respondents indicated they'd be continuing them in order to reach people outside of their community, and to reach under-represented and low-income populations who are either unable to get to the organization for programs or haven't been there before. The acknowledgement of increasing access to programs this way is encouraging, especially after a year which spotlighted the inequities in access to nature and environmental education (i.e. Rigolon et al., 2018).

Educators and learners alike also gained new skills with technology, teaching, learning, and interacting throughout the pandemic. This new knowledge will help inform environment education programs in perpetuity. While no one wanted to learn this way, educators and learners have gained new abilities to work together and respect each other on a human level. For EE organizations, this opens a world of programming for and engagement with their communities that was previous unknown.

Rapid Adapters

Results show that environmental educators are particularly good at adapting to change, as noted also by Gilbert (2020), Quay et al. (2020), and Sutton & Jones (2020). Working in a profession that is at the mercy of weather conditions, school closings, and volunteer support necessitates some nimbleness. The data collected in this study provides evidence to supports these claims. The variety of programs and materials offered by EE professionals shows creativity and determination to stay engaged with their communities. There is a dedication to their communities and a respect for their coworkers and collaborators that comes through clearly in the qualitative data. While no one should have to work under these conditions, environmental educators have shown a savvy and ability to adapt in uncertain and often unfortunate circumstances that is admirable.

Future Research

The data collected through this study is rich and offers many possibilities for future work. This study focuses on documenting what kinds of EE programs have been offered during the pandemic. More analysis of program offerings and successes by type

of organization or location will be an immediate continuation of these results. The data could be further examined for emotional and affective analysis (Saldaña, 2020). A deeper look at what factors impacted success of programs would provide useful information for the profession as well.

As the pandemic continues, more research about the response and importance of EE, impacts of virtual and outdoor learning, and other related topics will continue to emerge. Filling in gaps in research on how EE programs continue to evolve and respond to this information would be worthwhile, as well as follow up research related to Collins, et al., 2020, on the state of EE organizations. Additionally, work examining what actions can help these organizations during these trying times, and as they eventually recover, would be beneficial to the community.

Concluding Remarks

One of the challenges in doing this research was balancing the negative impacts of the pandemic on EE organizations with the potential benefits. Clearly teaching during a pandemic is a superhuman feat that should not be asked of anyone, and I did not want to downplay how incredibly hard these past 18 months have been for EE organizations. However, I do feel there is hope in the data I collected. These organizations have learned new technology and methods of teaching but also about themselves as organizations. A few respondents noted that the pandemic forced them to think strategically about their organization and used the opportunity to grow the organization in positive directions. The responses to *Q20 What, if anything, do you think learners gained from the changes to your programming?* were particularly hopeful. New audiences were reached, new

partnerships were formed, and new ways of teaching were tried. I am also living, teaching, and learning during this pandemic and it is heartening to see how environmental educators are trying to make life a little better for everyone right now.

The other theme that came from doing this research that I will carry with me as I embark on my career in environmental education is the importance of community in education. This is something I've read about in my coursework and something I know anecdotally, but after reading the literature and see the results to this survey, the value of making sure learners feel they are a welcome part of a larger community will not slip my mind or my practice in the future.

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APPENDIX A

Survey Instrument

Environmental Education in the COVID-19 Pandemic

Start of Block: Consent
Q1 Informed Consent to Participate in Research You are being asked to participate in a research study about environmental education programming in the United States during the COVID-19 pandemic. This survey contains questions about the types of programming offered by your organization during the COVID-19 pandemic, the success of those programs, and other reflections on the impact of the pandemic on your programs. Your participation is entirely voluntary, and you can refuse to participate or withdraw at any time. There is no compensation for participating in this study, and the only cost is time. This survey should take no longer than 30 minutes to complete. There are few mild risks associated with participating in this study. Talking about the pandemic can be distressing. We also ask about successes and failures, which can bring up upsetting feelings. You may decide not to answer any questions that make you uncomfortable for these or any other reasons. You may also pause the survey and return to it at a later time. There is a slight risk of the information you share with us becoming public and identifiable. We take your privacy very seriously and are taking every precaution to secure the information you provide us and protect your identity. No directly identifying information is being collected, unless you opt in to a follow up interview. Throughout the data collection and analysis, the data will be password protected and only available to the researcher. Thoroughly de-identified and aggregated data will be shared along side the study's resulting publication. A full description of your rights as a participant and more information about the study is available at this link: https://tinyurl.com/EEDuringCOVID19 If you have any questions about or do not understand something in this page, you can contact the researcher, Margaret Janz at mjanz01@hamline.edu for more information. Title of Research Study: Environmental Education During the COVID-19 Pandemic
Student Researcher and email address: Margaret Janz, mjanz01@hamline.edu
Faculty Advisor: Andreas Schramm, Hamline University, 651-523-2009, aschramm@hamline.edu

Q2 Do you agree to the terms of consent and wish to continue participating in this research?
- Yes (1)
- No (2)

Skip To: End of Survey If Do you agree to the terms of consent and wish to continue participating in this research? = No
End of Block: Consent

Start of Block: Demographics1

Q3 Which of the following best describes your organization?
- Nature or environmental learning center (1)
- Zoo or aquarium (2)
- Museum (3)
- Park or park system (4)
- Other (please describe) (5) _____

Q4 Is your organization:
- Nonprofit organization (1)
- For profit organization (2)
- Public or government organization (3)

Q5 Which of these best describes where your organization is located?
- Urban area (1)
- Suburban area (2)
- Rural area (3)

Q6 What audiences does your organization's programs reach? Select all that apply.
- Children in pre-k or kindergarten (1)
- Children in grades 1-5 (2)
- Children in grades 6-8 (3)
- High school-aged children (4)
- Higher education students (5)
- Adults (6)
- Senior citizens (7)
- Families (8)
- School groups (9)
- Home school children (10)

• General public (11)
• Scouts or Youth Groups (12)
• Other, please describe (13) _____

Q7 What types of programming does your organization typically provide? Select all that apply.
• Field trips (1)
• Summer camp (2)
• Onsite preschool (3)
• Master Naturalist or Gardener training (4)
• Public education programs (5)
• Guided nature walks or tours (6)
• Community programs (7)
• Service learning (8)
• Volunteer opportunities (9)
• Other, please describe (10) _____

End of Block: Demographics1

Start of Block: Covid-19 Changes
Q8 Did your organization offer programming during the first year of the COVID-19 Pandemic?
• Yes (1)
• No (2)

Skip To: End of Block If Did your organization offer programming during the first year of the COVID-19 Pandemic? = No

Q9 During the COVID-19 Pandemic did your organization cancel any of your typical program offerings?
• Yes (1)
• No (2)

Skip To: Q11 If During the COVID-19 Pandemic did your organization cancel any of your typical program offerings? = No

Carry Forward Selected Choices from "What types of programming does your organization typically provide? Select all that apply."

Q10 What types of programming did you cancel? Select all that apply.
- Field trips (1)
- Summer camp (2)
- Onsite preschool (3)
- Master Naturalist or Gardener training (4)
- Public education programs (5)
- Guided nature walks or tours (6)
- Community programs (7)
- Service learning (8)
- Volunteer opportunities (9)
- Other, please describe (10) _____

Q11 Did your organization alter how you offered programming?
- Yes (1)
- No (2)

Skip To: Q8 If Did your organization alter how you offered programming? = No

Carry Forward All Choices - Displayed & Hidden from "What types of programming does your organization typically provide? Select all that apply."

Q12 Which programs did you alter?
- Field trips (1)
- Summer camp (2)
- Onsite preschool (3)
- Master Naturalist or Gardener training (4)
- Public education programs (5)
- Guided nature walks or tours (6)
- Community programs (7)
- Service learning (8)
- Volunteer opportunities (9)
- Other, please describe (10) _____

Q13 What type of programming did your organization offer during the first year of the COVID-19 Pandemic? Select all that apply.
- Synchronous virtual educational programs (ie webinars) (1)
- Asynchronous virtual educational materials (ie activities ideas listed on websites) (2)
- Social media campaigns (3)

• Citizen science projects (4)
• Self-guided walks (5)
• Scavenger hunts or geocaching activities (6)
• Take-home nature kits (7)
• Other, please describe (8) _____

Carry Forward Selected Choices from "What type of programming did your organization offer during the first year of the COVID-19 Pandemic? Select all that apply."

Q14 Which programs do you think were most successful? Select all that apply.
• Synchronous virtual educational programs (ie webinars) (1)
• Asynchronous virtual educational materials (ie activities ideas listed on websites) (2)
• Social media campaigns (3)
• Citizen science projects (4)
• Self-guided walks (5)
• Scavenger hunts or geocaching activities (6)
• Take-home nature kits (7)
• Other, please describe (8) _____

Q15 What do you think contributed to the success of those programs?
_____
_____
_____
_____
_____

Carry Forward Selected Choices from "What type of programming did your organization offer during the first year of the COVID-19 Pandemic? Select all that apply."

Q16 Which programs do you think were least successful? Select all that apply.
• Synchronous virtual educational programs (ie webinars) (1)
• Asynchronous virtual educational materials (ie activities ideas listed on websites) (2)
• Social media campaigns (3)
• Citizen science projects (4)
• Self-guided walks (5)
• Scavenger hunts or geocaching activities (6)
• Take-home nature kits (7)
• Other, please describe (8) _____

Q17 What do you think hindered the success of those programs?

_____
_____
_____
_____
_____

End of Block: Covid-19 Changes

Start of Block: Reflection on Covid Changes
Q18 What have been the biggest challenges for offering programming during the COVID-19 Pandemic?

_____
_____
_____
_____
_____

Display This Question:
If Did your organization alter how you offered programming? = Yes
Or During the COVID-19 Pandemic did your organization cancel any of your typical program offerings? = Yes
Q19 What, if anything, do you think learners missed out on because you had to cancel or make changes to your programming during the first year of the COVID-19 Pandemic?

_____
_____
_____
_____
_____

Display This Question:
If Did your organization alter how you offered programming? = Yes
And Did your organization offer programming during the first year of the COVID-19 Pandemic? = Yes
Q20 What, if anything, do you think learners gained from the changes to your programming?

_____
_____
_____
_____
_____

Display This Question:
If Did your organization alter how you offered programming? = Yes
And Did your organization offer programming during the first year of the COVID-19 Pandemic? = Yes
Q21 Do you anticipate continuing any of the programming you offered during the pandemic once social distancing guidelines are lifted? Please describe which types. Enter N/A if none.

_____
_____
_____
_____
_____

Q22 What else would you like us to know about your programming during the COVID-19 Pandemic?

_____
_____
_____
_____
_____

End of Block: Reflection on Covid Changes

Start of Block: Mission statement
Q23 What is your organization's mission statement?

_____
_____
_____
_____
_____

End of Block: Mission statement

Start of Block: Demographics2

Q24 The data collected in this section will not be shared. Questions will be used only to combine responses from duplicate organizations.

Q25 What is the name of your organization?

_____

Q26 In which state is your organization?

▼ Alabama (1) ... I do not reside in the United States (53)

Q27 In what city is your organization?

_____

End of Block: Demographics2

APPENDIX B

"Other" Programming Offered During the First Year of the Pandemic

Appointment, family group nature center visitation

Audio Tour

camps for small groups of kids who were playing together (bubble groups);

Day camps (instead of overnight), additional public programs,

"Ding" at Home educational programs

eNews for Kids and Families

Extended Learning Camp (on site homework/school work help)

family programming on weekends in person

family "rent-a-naturalist" programs

field based programs

Fully outdoor learning

guided birding walks

Guided Nature Hikes for 9 or fewer people

hiking clubs

In person homeschool programs

In person summer camp

In person, socially distanced, masked programming of all types

Interactive onsite programs

Interactive PD for Teachers

live summer camp

master gardner training on site

nature blog with thematic activities for families

Off site programs - we went to their location rather than bringing them to ours

on-site field trips

On site programs: still did camp plus outdoor classes

onsite preschool and children and family programs

Onsite STEM program

Our trails remained open throughout the pandemic.

outdoor adult live-long learning programs

Outdoor only, limited participation numbers

outreach programs at schools

pop up outdoor programs

pre-recorded videos emailed to school groups

Pre-recorded videos

Presentations of naturalists outside

school yard programs (very limited)

science video with lab kits

Small Family Group Visits

Small group, half-day, family camp programs limited to 2 socially connected families..

Small groups sizes, all outdoors, mask use

Smaller in-person experiences

Story walks

Summer Camp

switched from standard formal public programming to static booth programming

Take home self-facilitated summer camps guided by video lesson, classroom kit activities and supplies guided by video lesson

take-home science kits that aligned with videos by museum staff

teacher training on site

Unlike other nearby nature centers, we kept our trails open during the pandemic.

Video education segments

Video recordings

Virtual Curriculum designed for classroom teachers

'Virtual" events where materials were provided

virtual festivals

Virtual walks and programs through Facebook Live

visits by appointment for individuals and individual families

vlogs

We also did in-person programs, all outdoors, masks and distancing required

We altered our public tours

We had to cancel a few programs but we offered in person camps and classes as well.

We offered in-person field programs in the summer but limited the group size and number of households (2 households, no more than 8 people total)

We offered very small programs for families and friend groups. six people max, all masked, outdoor, and we took everyone's temperatures prior to the program

We partnered with other local organizations, (libraries, community centers, childcare centers) to supplement their programming. This took the form of activity kits, live zoom activities, in-person programming (outdoors)

we did what we have done in the past, but less of it and in different ways, plus some new things

We went to a couple schools and provided on-site programming to their school. We did public programming and public shooting range day at our site, too.

Zoom educational experiments

zoom presentations